
ईंधन-ज्वलित गैस भट्टियाँ के लिए
सुरक्षा

Safety for Gas Fired Furnaces

ICS 25.180

© BIS 2017



भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली-110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.org.in www.standardsbis.in

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Industrial Fuel Fired Furnaces Sectional Committee, had been approved by the Metallurgical Engineering Division Council.

Safety is of utmost importance, especially for the gas fired industrial furnaces which are dealing with gas firing equipment.

Main reasons are :

- a) Furnaces should be designed and equipped for safe and reliable operation;
- b) All process parameters like temperature, pressure, flow of gas, combustion air supply and distribution to burners should be controlled within safe limit to avoid fire hazards; and
- c) Flame monitoring and supervisory system with gas leak detection, flame arrestor as preventive measures against fire and explosion.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SAFETY FOR GAS FIRED FURNACES

1 SCOPE

This standard deals with safety norms to be considered while designing and operating industrial furnaces with gas firing system.

2 GAS TRAIN EQUIPMENT

2.1 Furnace will be provided with gas train component comprising the following for safe and reliable operation (see Fig.1).

- Gas filter (optional),
- Over pressure safety shut off valve,
- Gas governor,
- Safety relief valve in bleed line,
- Solenoid operated safety shut-off valves,
- Solenoid relief valve in bleed line,
- Pressure gauges,
- High/Low gas pressure switch, and
- Manual shut off/isolation valves.

NOTES

1 Above items will be required for natural gas/LPG/any rich gas.

2 For low pressure gases like (BFG/COG) suitable gas train safety design device is provided.

2.2 The above gas train will have the following safety interlocks:

- In case the gas pressure is lower than the desired minimum gas pressure, the low pressure switch will give impulse to solenoid

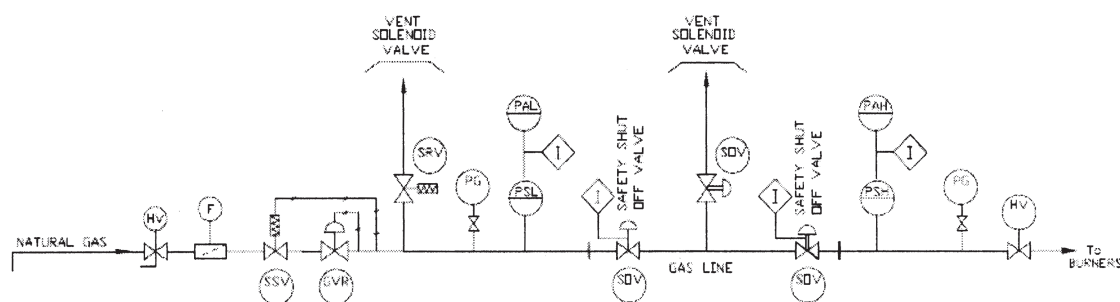
valves which will cut-off the gas supply to the furnace.

- In case the gas pressure is higher than the desired maximum gas pressure, the high pressure switch will give impulse to solenoid valves which will cut-off the gas supply to the furnace. In case of excessive gas pressure, the safety shut-off valve will cut-off gas supply and the safety relief valve will vent out excess pressure.
- The gas trapped to the solenoid valve will vent out of the shed through vent valve.
- Suitable filter is provided for gas train before the gas governor for safe operation of gas governor and solenoid.

3 AUTO GAS IGNITION AND FLAME FAILURE SAFETY DEVICE FOR BURNERS

3.1 For auto gas ignition of the burners through burner management panel/ PLC, the solenoid valve in the pilot gas line will be energized and will allow gas flow through pilot gas burners. Simultaneously, ignition transformer will fire and electric spark will ignite pilot gas flame.

3.2 The flame of the pilot gas burners will be sensed by UV photo cell which through amplifier will give signal to the gas solenoid valve of burner to be energized and supply fuel gas to the main burner which will now get ignited with the help of pilot gas burner flame. After lapse of 10-15 s ignition transformer will



HV = hand valve
SSV = safety shut-off valve
SRV = safety relieve valve
PSL = low pressure switch
SOV = solenoid valve
PAH = high pressure alarm

F = filter
GVR = governor
PG = pressure gauge
PAL = low pressure alarm
PSH = high pressure switch

FIG. 1 TYPICAL GAS TRAIN CONTROL LOOP

shut-off and pilot gas solenoid valve will also be de-energized. During regular burner firing the burner flame will be sensed through UV photo cell and will maintain constant supply of gas to the burner.

3.3 In case, the main burner flame fails due to any reason, the UV photo cell will immediately give signal through the amplifier to gas solenoid valve which will de-energize and shut-off the respective fuel line and audio- visual annunciator will show flame failure of respective burner.

3.4 Pilot gas burner will be switched off automatically after ignition of the main burner. This pilot gas burner will work on intermittent principle and will remain ON only for pre-set ignition that is 10-15 s after which flame supervision that is by UV photo cell will detect main burner flame only. The pilot burners are used as interrupted manner or intermittent way and the pilot burners are not kept continuously ON.

3.5 However, pilot burners are used for lean gases like producer gas and blast furnace gas. For rich gases like LPG, natural gas and coke oven gas etc, direct auto ignition (without a pilot burner) through spark igniter of main burner is done. Here, the working principle is similar to that of a pilot gas burner.

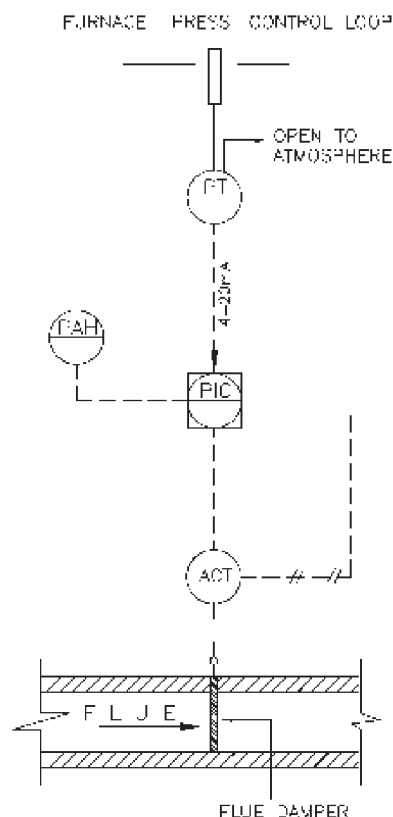
4 EXCESS ZONE TEMPERATURE CONTROL

Each zone of the furnace will be provided with a separate excess (override) temperature controlling system. In case the temperature of particular zone is not being properly controlled by the main zone temperature controlling system and exceeds beyond the safe operating temperature limit, this controller will give impulse to the respective solenoid valve to cut-off the gas supply to the burner. The system will include 1 number thermocouple, ON/OFF type temperature indicating controller and gas solenoid valve. In case the zonal temperature overshoots the maximum set value it will shut- off the zone fuel oil solenoid valve and at the same time the system will raise an audio-visual alarm.

In case of hot redundancy in PLC control the additional excess temperature controller is not required.

5 FURNACE PRESSURE CONTROL

In order to control the furnace pressure, one set of furnace pressure controlling instrument is provided which consists of furnace pressure transmitter, pressure indicating controller and actuator motor for flue damper actuation (*see* Fig. 2). In this instrumentation system, the furnace pressure is measured with respect to atmospheric pressure through pressure transmitter which gives signal to furnace pressure indicating controller. Based on the desired set furnace pressure, the pressure indicating controller will give impulse to the actuator for proportionately opening/closing of the



PT = pressure transmitter
PIC = pressure indicating controller
PAH = high pressure alarm
ACT = actuator

FIG. 2 FURNACE PRESSURE CONTROL LOOP

flue damper fitted in the flue passage. This process repeats all the times and controls the furnace pressure within the set limit to avoid flame shooting through furnace openings.

6 LOW COMBUSTION AIR PRESSURE

A low pressure switch will be installed in the combustion air line after the combustion air blower and will be interlocked with main gas solenoid valve. In case combustion air pressure is lower than the set pressure, there will be audio-visual alarm and pressure switch will give impulse to the gas solenoid valve which will cut-off the gas supply to the burner to avoid flow of unburnt gas in the furnace.

7 HIGH COMBUSTION AIR PREHEAT TEMPERATURE AFTER RECUPERATOR

7.1 The temperature controlling system comprising a thermocouple and ON/OFF temperature indicating controller will be provided in the combustion air line after recuperator so that if the temperature of combustion air exceeds beyond desired temperature, the controller will provide impulse to the modulating motor/pneumatic actuator of the hot air bleed control

valve to bleed off the hot air as safety measure to avoid burner operation system (see Fig. 3).

7.2 This hot air bleed control also protects the recuperator by allowing more cold combustion air flow through the recuperator tubes, thus reducing the mean wall temperature of the tubes.

8 SAFETY AGAINST HIGH ENTRY TEMPERATURE OF FLUE GAS TO RECUPERATOR

The temperature of flue gas before recuperator is controlled and kept within the safe limit. In this system, the flue gas temperature is sensed by thermocouple and signal is given to temperature indicating controller. Based on the set desired temperature of the flue gas, temperature indicating controller will give impulse to the actuator of the air control valve in the dilution air line which will open the air flow to the flue passage in order to limit the temperature of the flue gas at the recuperator entry.

9 NITROGEN PURGING

Nitrogen purging arrangement will be provided for purging of pipelines of gases. Purging of gas line from main isolating valve to burners is done before re-starting a furnace after prolonged shut down.

10 WATER SEALING OF GAS SUPPLY LINE

10.1 When gases like coke oven gas, producer gas and blast furnace gas are used as fuels, water sealing system is provided to ensure complete isolation of the gas flow to the furnace during prolonged shut down.

10.2 The sealing system will be of “U”/ “V”/ “drum” type with water inlet, overflow and drain valves, and gas isolation valves. When the gas flow is to be isolated, the gas isolation valves are closed, the sealing system is filled with water upto the desired overflow level.

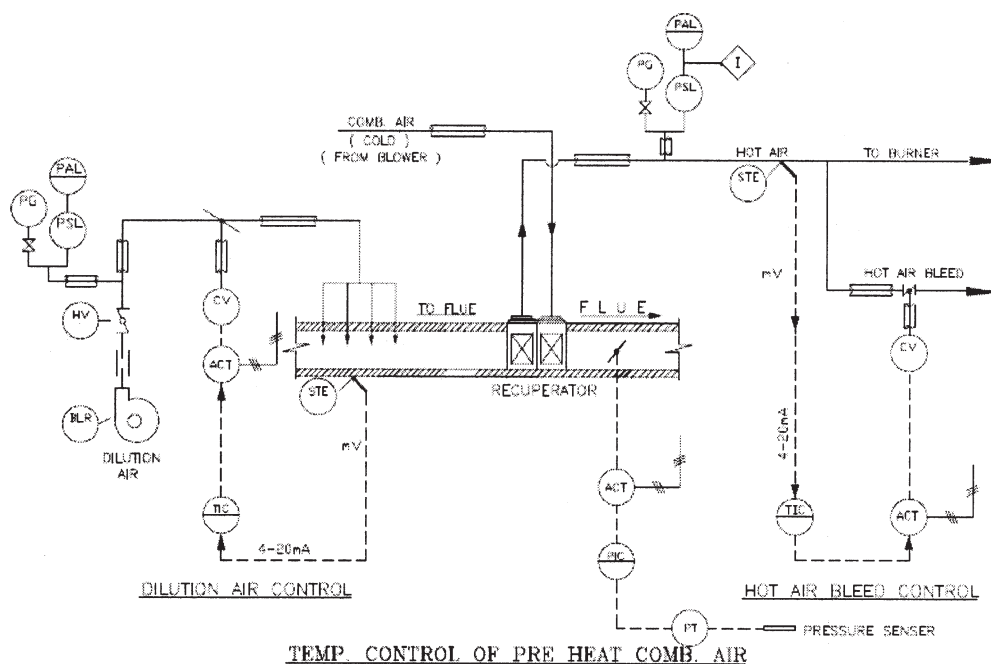
11 SPECIAL SAFETY SYSTEM

11.1 Gas Detectors

11.1.1 To detect leakage of gases from the pipelines or fittings, gas detectors are fitted over the gas train and in other suitable locations around the installed gas lines of furnace.

11.2 Flame Arrestor

For pipeline of highly inflammable gases, suitable flame arrestor is provided to prevent any fire hazard in the gas pipe installation by arresting the flame caused by back fire, to propagate it further.



TIC = temperature indicating controller
CV = control valve
PSL = low pressure switch
PAL = low pressure alarm
PT = pressure transmitter

ACT = actuator
HV = hand valve
PG = pressure gauge
PIC = pressure indicating controller

FIG. 3 P & T DIAGRAM — TEMPERATURE CONTROL OF PREHEAT COMBUSTION AIR AND DILUTION AIR CONTROL FOR RECUPERATOR ENTRY

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc No.: MTD 26 (5080).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones : 2323 0131, 2323 3375, 2323 9402

Website: www.bis.org.in

Regional Offices:

	Telephones
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 2323 7617 2323 3841
Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700054	{ 2337 8499, 2337 8561 2337 8626, 2337 9120
Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, CHANDIGARH 160019	{ 26 50206 265 0290
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	{ 2254 1216, 2254 1442 2254 2519, 2254 2315
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 2832 9295, 2832 7858 2832 7891, 2832 7892

Branches: AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi